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(54) CARBON BRUSH FOR ELECTRICAL MACHINES

(71) We, SCHUNK & EBE GMBH, a joint stock company organised under the laws of Germany, of Postfach 6420, 6300 Giessen 1, Germany, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to impregnated carbon brushes for use in electrical machinery.

Carbon brushes made from hard-burned carbon or electrographite are often impregnated with different organic or inorganic substances or mixtures, the object of the impregnation differing from one case to the next but, in general, it is intended to improve the running properties and to extend the working life of the brushes.

Impregnating the brushes with fats, oils or waxes is intended for example to produce a lubricant film on the collector running surface or on the slipring as the case may be. This in itself improves the running behaviour and reduces the wear which occurs. In many cases however, this improvement is not sufficient since even when using high-melting-point fats or waxes the advantageous effect is provided only for a certain length of time and this problem is exacerbated if high operating temperatures occur. In such cases currently used, the impregnating substances act mainly only as aids during the running-in period, since even after a relatively short time they become liquid as a consequence of high temperatures and issue from the brushes. As a result there may be the further disadvantage that when operation ceases the brushes may stick to the holder walls because of the impregnating agent which has issued from the brushes.

The present invention aims to provide a carbon brush which obviates disadvantages and which more particularly contains an impregnating agent which does not issue from the brush during the entire operating time of the brush, even at high operating temperatures.

Accordingly, the present invention provides an impregnated carbon brush for use in electrical machinery in which the impregnating agent is a non-melting fat, a non-melting wax or a non-flowing oil derived from a fat, wax or oil intimately mixed with a gelling agent consisting of montmorillonite flakes, the surfaces of which are coated with long-chain hydrocarbons.

The carbon brush according to the invention can also contain further inorganic and/or organic additives which improve the sliding properties and which are preferably present as a constituent of the impregnating agent. For example, metallic sulphides, metallix oxides or PTFE powder may be considered as such additives.

To produce carbon brushes according to the present invention, first of all carbon material such as hard-burned carbon or electrographite is produced in the usual way and then impregnated in accordance with the vacuum pressure method. The impregnating agent use according to the present invention consists of a solution of 0.1 to 30% by weight of the impregnating agent in a halogenated hydrocarbon such as, for example, trichloroethylene. Residual impregnating agent adhering to the surface of the brush is rinsed away by immersion in hot trichloroethylene. The carbon brush is then dried at about 80°C in order to expel the solvent. The proportion of impregnating agent remaining in the carbon material preferably amounts to 0.1 to 25% by weight relatively to the weight of the impregnated carbon material.

The carbon material for producing the brush may be inpregnated in a panel and the carbon brushes thereafter cut out from the carbon panel.

The kind of impregnating agent used will be described in detail hereinafter. The basis of

the impregnating agent is a fat, wax or oil having a synthetic, mineral, animal or vegetable base. This is modified by intimately mixing it with a gelling agent consisting of montmorillonite flakes, it being absolutely necessary to mix both components thoroughly, that at relatively high temperatures it maintains its stability and viscosity, in other words it does not melt and flow out. The production of such non-melting fats, waxes or oils is already known, but the use of these as impregnating agents for carbon brushes is new. The technical advance which is achieved becomes clear from the fact that the impregnating agent does not pass out even at an operating temperature of 300°C, whereas conventional impregnating agents pass out of the brush even after a relatively short time already at temperatures of about 150°C, and the advantageous effects on running behaviour are no longer obtained.

The advantageous effect of the brushes impregnated according to the present invention is shown clearly from the following test comparison results.

In a running test on a small carbon testing machine, brushes of the same carbon quality were tested:

1. Non-impregnated brushes
2. Brushes impregnated with high-melting-point paraffin
3. Brushes impregnated according to the present invention with non-melting fat.

With a current density of 6 A/cm^2 the brushes ran on a short-circuited collector, and the rotational speed was modified at various stages. The collector temperature, the brush wear and the coefficient of friction were measured respectively. The results which are assembled in Table 1 show clearly the advantage of the impregnation according to the present invention on the mechanical running properties of carbon brushes. For example, the carbon brush impregnated as proposed in the present invention only shows a wear of 2 µm/h with a peripheral speed of 20 m/sec for the collector, whereas the carbon brush impregnated with paraffin had a wear of 6 µm/h. The table shows that at a peripheral speed of 40 or 50 m/s respectively only the carbon brush according to the present invention is still usable.

TABLE 1

Results of running tests

Brush material	1. Non-impregnated			2. Impregnated with paraffin			3. Impregnated with non-melting fat		
measured quantity	coll. temp. °C	brush wear µm/h	coeff-icient of fric-tion	coll. temp. °C	brush wear µm/h	coeff-icient of fric-tion	coll. temp. °C	brush wear µm/h	coeff-icient of fric-tion
Peripheral speed (m/s)									
20	115	7.3	1.8	110	6.0	1.4	70	2.0	0.09
30	150	10.7	2.4	135	8.7	1.9	80	2.7	1.1
40	200	18.3	3.3	190	13.3	2.6	120	8.3	1.4
50							175	15.0	1.8

WHAT WE CLAIM IS

1. An impregnated carbon brush for use in electrical machinery in which the impregnating agent is a non-melting fat, a non-melting wax or a non-flowing oil derived from a fat, wax or oil intimately mixed with a gelling agent consisting of montmorillonite flakes, the surfaces of which are coated with long-chain hydrocarbons.

2. A carbon brush as claimed in claim 1 wherein the brush contains from 0.1 to 2.5% by weight of the impregnating agent based on the weight of the impregnated carbon brush.

3. A carbon brush as claimed in claim 1 or 2 wherein the brush contains further additives which improve its sliding properties.

4. A carbon brush as claimed in claim 3 wherein the additives are metallic sulphides, metallic oxides or PTFE in powder form.

5. An impregnated carbon brush substantially as herein described.

6. A method for producing an impregnated carbon brush as claimed in any preceding claim wherein a carbon brush is impregnated with a 0.1 to 30% by weight solution of an impregnating agent in a halogenated hydrocarbon by a vacuum pressure method, the residual impregnating agent adhering to the surface of the brush is rinsed away by immersion in hot trichloroethylene and the solvent is driven off by drying at 80°C.

7. A method as claimed in claim 6, wherein the carbon material for producing the brush is impregnated in a panel and wherein carbon brushes are thereafter cut out from the carbon panel.

8. A carbon brush substantially as herein described.

9. A method substantially as herein described of making an impregnated carbon brush for use in electrical machinery.

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